



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/605,444

09/30/2003

Douglas D. Coolbaugh

BUR920030091US1

2443

30449

7590

06/02/2004

SCHMEISER, OLSEN + WATTS

SUITE 201

3 LEAR JET

LATHAM, NY 12033

EXAMINER

MANDALA, VICTOR A

ART UNIT

PAPER NUMBER

2826

DATE MAILED: 06/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/605,444

Applicant(s)

COOLBAUGH ET AL.

Examiner

Victor A Mandala Jr.

Art Unit

2826

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 08 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) 3,9-13,16 and 25-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,4-8,14,15 and 17-24 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 9/30/03 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 9/30/03.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Response to Election/Restrictions*

1. Claims 3, 9-13, 16, and 25-30 are withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected Species, there being no allowable generic or linking claim. Examiner does take note that claim 3 depends on claim 1 and claim 16 depends from 14 and that if claims 1 and 14 are found allowable a rejoinder of claims 3 and 16 will be done. Applicant timely traversed the restriction (election) requirement in Paper filed. 4/08/04. The Applicant argues that the search of all species would not be a serious burden to the examiner, but the examiner does not find this argument persuasive on the basis the present application has seven different species, which would be a serious burden on the examiner; thus the restriction is made final.

### *Drawings*

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the top electrode in direct contact with the MIM dielectric must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1, 2, 4, 5-8, 14, 15, 17-24 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claims 1 and 14 recited the limitation that the top electrode is in direct contact with the top surface of said MIM dielectric, but Figures 5A-F does not teach this and neither does the specification. Figure 5A-F does not label the layer that is in between the top electrode # 438A2 and the MIM dielectric #436A, but in Figure 1A the intermediate layer is labeled properly. Figure 1 teaches the intermediate layer #160 to be made out of TiN or TaN and that this layer is utilized in all embodiments of the invention, (Applicant's Specification Paragraph 0019 Lines 12-15); thus not enabling.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the fourth paragraph of 35 U.S.C. 112:

Subject to the following paragraph, a claim in dependent form shall contain a reference to a claim previously set forth and then specify a further limitation of the subject matter claimed. A claim in dependent form shall be construed to incorporate by reference all limitations of the claim to which it refers.

4. Claims 4, 5, 17, and 18 are rejected under 35 U.S.C. 112, fourth paragraph, as for not incorporating by reference all limitations of the claim to which it refers. Claims 4 and 17 do not reference the limitation in the independent claims 1 and 14 that the bottom copper electrode is co-planar with the top surface of the interlevel dielectric, where claims 4 and 17 teach an additional diffusion layer is co-planar with the interlevel dielectric, and where is later taught in claims 5 and 18 that this layer isn't made out of copper either.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 7, 14, 15, and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by  
U.S. Patent No. 6,734,489 Morimoto et al.

5. Referring to claim 1, an electronic device, (insofar as to understand the claims from the 112 rejections), comprising: an interlevel dielectric layer, (Figure 55 #15), formed on a semiconductor substrate, (Figure 1 #1); a copper bottom electrode, (Figure 55 #30 & Col. 14 Line 7), formed in said interlevel dielectric layer, (Figure 55 #15), a top surface of said bottom electrode co-planer with a top surface of said interlevel dielectric layer, (Figure 55 #152); a conductive diffusion barrier, (Figure 55 #44), in direct contact with said top surface of said bottom electrode, (Figure 55 #30); a MIM dielectric, (Figure 55 #45), in direct contact with a top surface of said conductive diffusion barrier, (Figure 55 #44); and a top electrode, (Figure 55 #33), in direct contact with a top surface of said MIM dielectric, (Figure 55 #45).
6. Referring to claim 2, an electronic device, wherein said conductive diffusion barrier, (Figure 55 #44), and said MIM dielectric, (Figure 55 #45), both extend past at least two sides of said bottom electrode, (Figure 55 #30).
7. Referring to claim 7, an electronic device, wherein said MIM dielectric, (Figure 55 #45), comprises about 2 to 20 nm of  $\text{SiO}_2$ ,  $\text{Si}_3\text{N}_4$  or  $\text{SiC}$ , a high K dielectric,  $\text{Ta}_2\text{O}_5$ ,  $\text{BaTiO}_3$ ,  $\text{HfO}_2$ ,  $\text{ZrO}_2$  or  $\text{Al}_2\text{O}_3$ , or combinations of layers thereof, (Col.17 Lines 7-9).
8. Referring to claim 14, a method of fabricating an electronic device, (insofar as to understand the claims from the 112 rejections), comprising:
- (a) providing a semiconductor substrate, (Figure 1 #1),
  - (b) forming an interlevel dielectric layer, (Figure 55 #15), on said semiconductor substrate, (Figure 1 #1);

Art Unit: 2826

- (c) forming a copper bottom electrode, (Figure 55 #30 & Col. 14 Line 7), in said interlevel dielectric layer, (Figure 55 #15), a top surface of said bottom electrode, (Figure 55 #30), coplanar with a top surface of said interlevel dielectric layer;
- (d) forming a conductive diffusion barrier, (Figure 55 #44), in direct contact with said top surface of said bottom electrode, (Figure 55 #30);
- (e) forming a MIM dielectric, (Figure 55 #45), in direct contact with a top surface of said conductive diffusion barrier, (Figure 55 #44); and
- (f) forming a top electrode, (Figure 55 #33), in direct contact with a top surface of said MIM dielectric, (Figure 55 #45).

9. Referring to claim 15, a method, wherein said conductive diffusion barrier, (Figure 55 #44), and said MIM dielectric, (Figure 55 #45), both extend past at least two sides of said bottom electrode, (Figure 55 #30).

10. Referring to claim 20, a method, wherein said MIM dielectric, (Figure 55 #45), comprises about 2 to 20 nm of SiO<sub>2</sub>, Si<sub>3</sub>N<sub>4</sub> or SiC, a high K dielectric, Ta<sub>2</sub>O<sub>5</sub>, BaTiO<sub>3</sub>, HO<sub>2</sub>, ZrO<sub>2</sub> or Al<sub>2</sub>O<sub>3</sub>, or combinations thereof, (Col.17 Lines 7-9).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 12 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S.

Art Unit: 2826

11. Referring to claim 6, an electronic device, wherein said conductive diffusion barrier, (Figure 55 #44), comprises about 5 to 200 nm of a refractory metal, W, Ta, TaN, WN, TaN, TaSiN, Pt, IrO<sub>2</sub> or RuO<sub>2</sub> or combinations thereof, (Col. 13 Lines 35-36 & Col. 13 Lines 59-61 where layer #31 in Figure 55 is shown to have the same dimensional thickness).

Note that the specification contains no disclosure of either the critical nature of the claimed dimensions or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

12. Referring to claim 19, a method, wherein said conductive diffusion barrier, (Figure 55 #44), comprises about 5 to 200 nm of a refractory metal, W, Ta, TaN, WN, TaN, TaSiN, Pt, IrO<sub>2</sub> or RuO<sub>2</sub> or combinations thereof, (Col. 13 Lines 35-36 & Col. 13 Lines 59-61 where layer #31 in Figure 55 is shown to have the same dimensional thickness).

Note that the specification contains no disclosure of either the critical nature of the claimed dimensions or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 8 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S.

Patent No. 6,734,489 Morimoto et al. in view of U.S. Patent Application Publication

2003/0032234 Suzuki.



Art Unit: 2826

13. Referring to claim 8, an electronic device, wherein said top electrode, (Morimoto et al. Figure 55 #33), comprises Al or W, (Suzuki Figure 16 #33 & Paragraph 0099 Line 5).

Morimoto et al. discloses the claimed invention except for the top electrode to be made out of W or Al, but Suzuki does. It would have been obvious to one having ordinary skill in the art at the time the invention was made to make the top electrode to be made out of W or Al, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice.  
In re Leshin, 125 USPQ416.

14. Referring to claim 21, a method, wherein said top electrode, (Morimoto et al. Figure 55 #33), comprises Al or W, (Suzuki Figure 16 #33 & Paragraph 0099 Line 5).

Morimoto et al. discloses the claimed invention except for the top electrode to be made out of W or Al, but Suzuki does. It would have been obvious to one having ordinary skill in the art at the time the invention was made to make the top electrode to be made out of W or Al, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice.  
In re Leshin, 125 USPQ416.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Victor A Mandala Jr. whose telephone number is (571) 272-1918.

The examiner can normally be reached on Monday through Thursday from 8am till 6pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on (571) 272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 2826

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

VAMJ  
5/26/04



**NATHAN J. FLYNN**  
**SUPERVISORY PATENT EXAMINER**  
**TECHNOLOGY CENTER 2800**